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Six experiments were conducted in the Warrior Run School District, Pa., during the first year of a Title III, ESEA, program designed to (1) investigate motivational techniques to determine which are most effective with elementary school pupils and (2) investigate the differential effects of selected motivational techniques with pupils of different ability and sex. Nearly all district elementary teachers were involved in randomly assigning pupils to treatments, designing independent variable measures, and administering experimental treatments. Experiments used cognitive and attitude tests to measure the effects of (1) pretests and availability of instructional materials (201 first graders, 196 second graders, and 185 third graders); (2) methods of giving homework assignment (486 fourth, fifth, and sixth graders); (3) curiosity arousal and teacher established set (565 first, second, and third graders); (4) pretests and feedback (186 fourth graders); (5) teacher cognizance of collected homework (143 fifth graders); (6) teacher cognizance of noncollected homework (185 sixth graders). Statistically significant effects were observed in experiments 1, 2, and 3, nonsignificant treatment effects also occurred in some, possibly because of failure to control extraneous variables. (One section of the report is devoted to each experiment, each including literature review, methodology, results, discussion, and conclusions.) (JS)

PROJECT SESAME

TECHNICAL DOCUMENT NUMBER 8

THE INVESTIGATION OF MOTIVATION OPTIONS OPEN TO THE ELEMENTARY SCHOOL TEACHER

SEPTEMBER, 1967 to AUGUST, 1968

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and

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PREFACE

Project SESAME (Susquehanna ESEA Synergetic Activities and Multi-innovative Experiences) is a regional complex of projects involving each of 18 school districts, as well as the non-public schools, in Columbia, Montour, Northumberland, Union, and Snyder Counties in central Pennsylvania. This program, and other SESAME undertakings (SESAME A in arts, and SESAME G in games) are financed primarily with Title III, ESEA, funds. The principal objective of the program is to improve opportunities for pupil learning by developing a model for the coordination of smaller school districts' innovative ventures and by stimulating professional staff. To this end, diverse innovative, experimental, and curriculum programs affecting elementary and secondary school systems in the Region are supported and coordinated.

The purpose of a Technical Document is to present evaluative or research data which supports either a working document or practical document, or which reports data and results of SESAME projects, conferences, and/or experiments.

This particular technical document summarizes the six experiments which were conducted in the Warrior Run School District during the 1967-68 school year. The series of experiments was planned, initiated, and carried out by myself and Mr. James R. Sanders, with considerable administrative assistance from Mr. Orrin G. Cocks, Jr., Superintendent, and Mr. John R. Lyle, Elementary Supervisor, of the Warrior Run School District. The first experiment is primarily the work of Mr. Sanders and represents a summary of Technical Document Number 2 (which, in turn, is a summary of Mr. Sanders' Masters Thesis for Bucknell University).

The content of this technical document is obviously applicable to many of the other SESAME programs underway in the five counties and also to school programs generally. Motivation is a critical concept in our schools as currently structured. These early and systematic attempts to understand this phenomenon better will hopefully result in long-range dividends. Experiences gained during the first year of this program should also be of great value in planning experimentation to be conducted in school year 1968-69.

It is important to note the extensive cooperation that was afforded by the Warrior Run School District on this particular project. In addition to extensive administrative assistance, the entire teaching staff of the elementary schools in the district was extremely dedicated and cooperative in the actual implementation of these various studies. It is felt that undertakings of this type, representing a coordinated and mutual approach by university and public school representatives, hold much promise for the ultimate improvement of instructional programs.

Dr. William L. Goodwin
Project Director

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INTRODUCTION

In December, 1966, planning meetings between Mr. Orrin G. Cocks, Jr., Superintendent, Mr. John R. Lyle, Elementary Supervisor, of the Warrior Run School District, and Dr. William L. Goodwin of Project SESAME, indicated a need to investigate systematically the motivation options open to the elementary school teacher. These plans were incorporated as Innovative Sub-program #12, Project SESAME. The proposal was subsequently funded and commenced operation on September 1, 1967. This is a report of the technical data that resulted from the first year of this program; that is, from September 1, 1967, to August 31, 1968.

The objectives of the program are listed below:

1. To investigate motivational techniques to determine which are most effective with elementary school pupils.
2. To investigate the differential effects of selected motivational techniques with different types of pupils.
3. To investigate the variables related to achievement motivation in the classroom.

During this initial year progress toward Objective 1 was pronounced as a series of six experiments was conducted; progress was equally apparent on Objective 2 as assigned independent variables (such as sex and ability) were incorporated in most of the six experiments. Attention was not focused on Objective 3 during Year 1; it is possible that, using a different type of research methodology, more attention will be directed toward this Objective in Year 2.

This program concentrated upon studying questions concerning motivation which were initiated at the school level. Even though the initiative and stimulation for the experiments came from the practitioners in the field, this should not imply that the research undertaken was anything but rigorous and systematic. In the series of experiments that

was conducted, nearly all of the elementary teachers in the district were involved, often in the processes of randomly assigning pupils to treatments or even designing some of the dependent variable measures; these activities served as valuable inservice learning experiences for the staff. In many cases, the teachers also served as sub-experimenters administering experimental treatments.

The table that follows presents in summary form the six experiments conducted as well as a brief synopsis of the results. It also establishes the organizational structure for this technical report as each of the six experiments is presented in detail in the next six sections. For each experiment the standard reporting format is used; that is, review of the literature, methodology, results, and discussion and conclusions. A final section in this document details the most salient outcomes of the first year experiments.

Experiment Number and Title	Subjects	Active Independent Variables	Assigned Independent Variables	Statistically Significant Results (Main effects and first-order interactions only).
1: Effects of Pre-tests and Availability of Instructional Materials.	201 First graders; 196 Second graders; 185 Third graders.	Pre-test: Given (P) or not given (NP). Materials: Posted on walls (M) or not posted (NM).	Ability: High (HA), Average (AA), or Low (LA). Sex: Male (Ma) or female (F).	On cognitive test: M outperformed NM (Grades 1 and 2). HA outperformed AA; AA outperformed LA (Grades 1 and 3). P & M outperformed P & NM (Grade 1). NP & HA outperformed NP & AA, NP & LA, and P & LA (Grade 3). On attitude test: NP more favorable than P (Grade 3). NP & M, and P & NM more favorable than NP & NM, and P & M (Grade 2). NP & NM more favorable than P & NM (Grade 3).
2: Effects of Methods of Giving Homework Assignments.	486 Fourth, fifth, and sixth graders.	Assignments: Written on chalkboard no explanation (A); oral with oral explanation (B); written on paper, with oral explanation (C); written on paper plus parental note (D).	Sex: Male (M) or female (F).	On cognitive test: No differences. On attitude test: C more favorable than D; D more favorable than A and B.
3: Effects of Curiosity Arousal and Teacher-Established Set.	646 First, second, and third graders.	Curiosity: Aroused (C) or not aroused (NC). Teacher set: Elaborate (S) or cursory (NS).	Ability: High (HA), Average (AA), or Low (LA). Sex: Male (M) or female (F). Grade: One (1), two (2), or three (3).	On cognitive test: NC outperformed C. HA outperformed AA; AA outperformed LA. M outperformed F. 3 outperformed 2; 2 outperformed 1.

	Experiment Number and Title	Subjects	Active Independent Variables	Assigned Independent Variables	Statistically Significant Results (Main effects and first-order interactions only).
4:	Effect of Pre-tests and Feed-back.	186 Fourth graders.	Relevant pre-test and relevant feedback (A); Relevant pre-test and irrelevant feedback (B); Irrelevant pre-test and irrelevant feed-back (C).	Ability: High (HA); Average (AA); and Low (LA). Sex: Male (M) or female (F). School: Watsontown (W) or Turbotville (T).	On cognitive test: HA outperformed AA; AA out-performed LA. All groups outperformed LA & T. Also, HA & T and HA & W out-performed AA & W and LA & W.
5:	Effect of Teacher Cognizance of Collected Homework.	143 Fifth graders.	Homework scored and collected: Recorded (comments) and returned (A); Not recorded but returned (B); Not recorded and not returned (C).	Sex: Male (M) or female (F). School: Watsontown (W) or Turbotville (T).	On cognitive test: No differences.
6:	Effect of Teacher Cognizance of Non-collected Homework.	185 Sixth graders.	Homework scored but not collected: Recorded by teacher (A); Randomly recorded by teacher (B); Not recorded by teacher (C).	Sex: Male (M) or female (F). School: Watsontown (W) or Turbotville (T).	On cognitive test: W outperformed T.

EXPERIMENT 1: THE MOTIVATIONAL EFFECTS OF PRE-TESTING AND THE AVAILABILITY OF INSTRUCTIONAL MATERIALS [1]

Motivation must be considered as one of the most important factors in learning. Berlyne (1954a, 1960) pointed out that human beings are prone to look at and look for, ask about and think about things, even when nobody tells them to do so. It is not easy, however, to indicate which conditions arouse and direct the child when nobody is explicitly motivating him. If we could define and describe what procedures will motivate the student to learn, we would be making a valuable contribution to the classroom teacher.

Gagné (1965) suggested one way of attacking the problem by pointing out that there is an enormous dependence on environmental circumstances for learning. Berlyne (1954b) suggested another approach by providing data to support the contentions (1) that pre-questioning a student before a unit of instruction is presented arouses curiosity, and (2) that, during instruction, statements recognized as answers to the pre-test are most likely to be recalled in a post-test.

The following seven assumptions were made in order to provide a logical foundation for the experimental hypotheses:

1. The application of a pre-test before any instruction is presented has an arousal effect which is manifested in behavior directed toward gaining information about the questions contained in the pre-test. Maw and Maw

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[1] This section represents a condensation of Project SESAME Technical Document No. 2.

(1964) reached the conclusion that the values of curiosity seem to be threefold in that (1) learning depends on curiosity, (2) creativity requires curiosity, and (3) sound mental health demands that the individual be curious. Another important effect of the pre-test, other than its arousal value, is the "set" which it provides for the student in becoming selectively attentive to certain stimulus events. Gagné (1965) stated that the student must be attentive to the stimulation if he is to learn, while Travers (1964) felt that the use of an instrument such as a pre-test should facilitate learning by decreasing the number of irrelevant dimensions in the stimulus situation.

2. Providing instructional materials supplies the learner with much information. Gagné (1965) suggested this approach in stating that one component of instruction which will facilitate learning of material is the furnishing of external prompts. Travers (1964) stated that pictorial material is introduced into learning situations to serve two main purposes: to motivate; and to transmit information.

3. Sex differences exist when amount of curiosity aroused in the classroom is considered. These differences have been reported by Davis (1932), Gatto (1929), Gewirtz (1954), Siebert (1928), and Smith (1933).

4. There are differences in amount of curiosity demonstrated in the classroom among pupils of dissimilar mental ability levels (postulating that students of high intelligence will demonstrate more curiosity than students of average or low intelligence).
5. Group motivational methods are most logical when one is dealing with a large number of students. Sims (1928) demonstrated that individual motivational methods were superior to group methods.
6. One can expect significant interaction effects when experimenting in the classroom (McKeachie, 1961).
7. Audio-visual instruction is a highly effective means of presenting information to young students (Travers, 1964).

In summary of the preceding, it should be noted that methods developed to motivate children in the classroom are not readily available. One primary consideration in developing such methods is the ease of implementation by the teachers. This experiment tests two options which the teacher might consider: using pre-tests before units of instruction; and making materials used in instruction readily available to the learners.

Based on the seven postulates stated above, the following hypotheses, stated in the null form, were selected to be tested.

(1) There is no significant difference in post-test scores or attitudes toward the instructional material between a group given a pre-test and one not given a pre-test.

(2) There is no significant difference in post-test scores or attitudes toward the instructional material between a group to whom instructional materials are made available and a group to whom no materials are made available.

(3) There is no significant difference in post-test scores or attitudes toward the instructional material between male and female pupils.

(4) There is no significant difference in post-test scores or attitudes toward the instructional material between high, average, and low ability pupils.

(5) There are no significant interaction effects on post-test scores or attitudes toward the instructional material when interactions between treatment groups, IQ, and sex are considered.

(6) There is no significant difference between performance on "old" and "new" items for the pre-test and no pre-test groups.

METHOD

Subjects

The Ss were 201 first grade (105 males, 96 females), 196 second grade (96 males, 100 females), and 185 third grade (99 males, 86 females) students enrolled in five schools in the Warrior Run School District in Pennsylvania. The schools are located in a rural, small town setting.

Experimental Design

Subjects were stratified by sex and IQ. Intelligence scores on a pre-school test (Detroit Intelligence Test) were used to identify low,

average, and high ability males and females. The IQ ranges were as follows: low-63 to 102; average-104 to 117; and high-118 to 152. Ss in each of the resultant six cells were then randomly assigned to the pre-test or no pre-test groups; entire classes were then randomly assigned to the materials available or no materials available groups. The resultant paradigm for the experiment was a 2 x 2 x 3 x 2 complete factorial design with unequal n's. Two dependent variables, a cognitive post-test and attitude gain, were involved in the experiment. A four-way analysis of variance was used to analyze the cognitive post-test data, while a four-way analysis of covariance was used to analyze the attitude data.

Procedures

Two weeks before the beginning of the experimental period, a 10-item attitude pre-test was administered to all Ss. On the first day of the experimental period, cognitive pre-tests were given to those Ss receiving that treatment. The first grade test was on addition facts, the second grade test was on art and artists, and the third grade test was on mathematical set theory; these cognitive pre-tests were an integral part of the treatment.

On days two, three, and four, instruction in the three areas mentioned above was provided. Each teacher spent approximately 20 minutes each day using instructional tapes synchronized with transparencies or slides. At the end of each day's lesson, teachers in classes assigned to the availability of materials treatment put up relevant materials on their bulletin boards, where these remained until removed on the beginning of day five. Teachers were instructed not to initiate any discussion of the materials, but if questions were asked, to answer them.

On day five, teachers administered the 10-item attitude post-test and a 20-item cognitive post-test. The attitude test was identical to the one administered three weeks earlier; the cognitive test consisted of the 10 items in the pre-test given on day one and 10 new items.

RESULTS

The BMD05V (UCLA, 1964) computer program was used to run the analyses of variance and covariance. A locally-written program analyzed differences between the "new" and "old" item questions for the two levels of the pre-test factor.

Table 1 presents the F-ratios and mean squares for the cognitive post-test performance at each of the grade levels. For the first grade, significant F values were found for materials, for ability, and for the pre-test x materials interaction. Means for the levels of these factors are found in Table 2. A Newman-Keuls analysis was run to identify the sources of variance within the ability factor. This analysis showed that both the high and average ability groups performed significantly better than the low ability group at the .01 level, and that the high ability group performed significantly better than the average ability group at the .05 level. A Newman-Keuls analysis for the pre-test x materials interaction showed that the difference between the pre-test, materials group and the pre-test, no materials group was significant at the .01 level.

In Table 1 are also presented the F-ratios and mean squares for the cognitive post-test performance at the second grade level. Here again the availability of materials factor was found to be significant. The means for the two levels of this factor are found in Table 2.

Table 1

F-Ratios and Mean Squares for Performance by Grade

Source	d.f.	Grade 1 MS	Grade 1 F	Grade 2 MS	Grade 2 F	Grade 3 MS	Grade 3 F
Pre-test (P)	1	.04	--	6.84	--	4.48	1.04
Materials (M)	1	155.46	8.90**	12.86	13.43**	12.61	2.94
Ability (A)	2	197.47	11.31**	24.56	2.92	4o.11	10.75**
Sex (S)	1	29.18	1.67	.17	--	4.52	1.05
P x M	1	115.74	6.63*	.59	--	5.51	1.29
P x A	2	3.36	--	7.01	--	26.03	6.07**
P x S	1	2.25	--	5.16	--	4.02	--
M x A	2	5.87	--	6.41	--	4.38	1.02
M x S	1	6.11	--	5.75	--	1.42	--
A x S	2	.08	--	15.22	1.81	4.85	1.13
P x M x A	2	5.34	--	6.92	--	14.31	3.33*
P x M x S	1	4.94	--	6.88	--	1.99	--
P x A x S	2	2.86	--	1.09	--	1.39	--
M x A x S	2	2.40	--	17.51	2.08	4.06	--
P x M x A x S	2	20.34	1.16	10.63	1.26	14.59	3.40*
Error Grade 1	177						
Error Grade 2	172	17.46		8.40		4.29	
Error Grade 3	161						

NOTE: In this and all subsequent tables, a hyphen indicates a $F<1$.

*$p < .05$

**$p < .01$

Table 2

Means for Significant F-Ratios for Performance; Grades 1, 2, and 3

Source	Grade	Level	Mean
Materials	1	Available	12.68
		Not Available	10.97
Ability	1	High	13.81
		Average	12.48
		Low	9.81
Pre-test x Materials	1	Pre-test, Materials	13.56
		No Pre-test, Materials	11.94
		No Pre-test, No Materials	11.55
		Pre-test, No Materials	10.16
Materials	2	Available	9.32
		Not Available	8.04
Ability	3	High	4.33
		Average	3.44
		Low	2.80
Pre-test x Ability	3	No Pre-test, High Ability	5.00
		Pre-test, Average Ability	3.86
		Pre-test, High Ability	3.72
		No Pre-test, Average Ability	3.03
		Pre-test, Low Ability	2.93
		No Pre-test, Low Ability	2.62
Pre-test x Materials x Ability	3	No Pre-test, Mat., High Abil.	6.88
		No Pre-test, No Mat., High Abil.	4.17
		Pre-test, Mat., Average Abil.	4.08
		Pre-test, No Mat., High Abil.	3.89
		Pre-test, No Mat., Av. Abil.	3.71
		Pre-test, Mat., High Ability	3.45
		Pre-test, Mat., Low Ability	3.14
		No Pre-test, Mat., Av. Abil.	3.06
		No Pre-test, No Mat., Av. Abil.	3.00
		No Pre-test, Mat., Low Abil.	2.75
		Pre-test, No Mat., Low Abil.	2.50
		No Pre-test, No Mat., Low Abil.	2.33

(Table 2 Continued)

Source	Grade	Level	Mean
Pre-test x Materials x Ability x Sex	3	No Pre-test, Mat., High Abil., F	8.00
		No Pre-test, Mat., High Abil., M	6.20
		No Pre-test, No Mat., High Abil., M	4.75
		Pre-test, Mat., Av. Abil., F	4.43
		Pre-test, Mat., High Abil., M	4.40
		No Pre-test, Mat., Av. Abil., F	4.38
		Pre-test, No Mat., High Abil., F	4.00
		Pre-test, No Mat., Av. Abil., F	3.86
		Pre-test, No Mat., High Abil., M	3.80
		No Pre-test, No Mat., High Abil., F	3.70
		Pre-test, Mat., Av. Abil., M	3.60
		Pre-test, No Mat., Av. Abil., M	3.60
		Pre-test, Mat., Low Abil., F	3.57
		No Pre-test, No Mat., Low Abil., F	3.50
		No Pre-test, Mat., Low Abil., M	3.27
		No Pre-test, No Mat., Av. Abil., F	3.17
		No Pre-test, No Mat., Av. Abil., M	2.88
		Pre-test, Mat., Low Abil., M	2.71
		Pre-test, Mat., High Abil., F	2.67
		Pre-test, No Mat., Low Abil., M	2.63
		Pre-test, No Mat., Low Abil., F	2.33
		No Pre-test, Mat., Low Abil., F	2.11
		No Pre-test, No Mat., Low Abil., M	2.00
		No Pre-test, Mat., Av. Abil., M	1.75

At the third grade level, the ability factor was found to be significant. In addition, three interactions involving the pre-test factor and ability were found to have a significant effect on Ss' responses. These interactions were the pre-test x ability factors interaction, the pre-test x materials x ability factors interaction, and the pre-test x materials x ability x sex factors interaction. The means for the levels of these sources of variance are found in Table 2. A Newman-Keuls analysis for the ability factor showed that the difference between the high ability group and the low ability group was significant at the .01 level, while the difference between the high and average ability groups was significant at the .05 level. For the pre-test x ability interaction, a Newman-Keuls analysis showed that the differences between the no pre-test, high ability group and the no pre-test, low ability group, the pre-test, low ability group, and the no pre-test, average ability group were significant at the .01 level. The differences between the no pre-test, high ability group and the pre-test, high ability, and the pre-test, average ability groups were significant at the .05 level. A Newman-Keuls analysis for the pre-test x materials x ability interaction showed that the differences between the no pre-test, materials, high ability group and all other groups were significant at the .01 level.

Table 3 presents the F-ratios and mean squares for the attitude variable at each of the grade levels. For grade one, only the covariate was significant, indicating a great variation in pre-test scores.

At the second grade level, the pre-test x materials interaction and the covariate were found to be statistically significant. The

Table 3

F-Ratios and Mean Squares for Attitude by Grade

Source	d.f.	Grade 1 MS	Grade 1 F	Grade 2 MS	Grade 2 F	Grade 3 MS	Grade 3 F
Pre-test (P)	1	48.54	--	25.14	--	227.98	4.49*
Materials (M)	1	1.34	--	.04	--	7.74	--
Ability (A)	2	112.60	1.16	1.50	--	14.32	--
Sex (S)	1	.09	--	.12	--	17.12	--
P x M	1	16.77	--	578.34	12.55**	329.41	6.48*
P x A	2	38.49	--	121.81	2.64	28.04	--
P x S	1	47.63	--	13.96	--	26.19	--
M x A	2	36.83	--	6.39	--	80.77	1.59
M x S	1	11.95	--	168.02	3.65	2.98	--
A x S	2	47.78	--	47.76	1.04	4.33	--
P x M x A	2	103.54	1.06	59.28	1.29	17.89	--
P x M x S	1	185.87	1.92	19.91	--	22.30	--
P x A x S	2	108.14	1.11	3.27	--	30.75	--
M x A x S	2	49.71	--	18.39	--	85.75	1.69
P x M x A x S	2	129.22	1.33	32.82	--	4.66	--
Covariate	1	1753.43	18.07**	3568.92	77.43**	5175.88	101.85**
Error Grade 1	176						
Error Grade 2	171	97.03		46.09		50.82	
Error Grade 3	160						

*p < .05

**p < .01

adjusted means calculated for the four levels of the pre-test x materials factor on the attitude variable are found in Table 4. A Newman-Keuls analysis showed attitudes of the no pre-test, materials group significantly greater than the pre-test, materials group ($p < .01$), and the no pre-test, no materials group ($p < .05$). The differences between the pre-test, no materials group and both the pre-test, materials and the no pre-test, no materials group were significant at the .05 level.

At the third grade level, also in Table 3, the pre-test factor was found here to be a significant source of variance, those pupils not receiving the pre-test having more favorable attitudes. In addition, the pre-test x materials interaction and the covariate were found to be statistically significant. The adjusted means calculated for the levels of these sources of variance on the attitude variable are found in Table 4. A Newman-Keuls analysis showed that the difference between the no pre-test, no materials group and the pre-test, no materials group was significant at the .01 level.

Mean scores and standard deviations of the two levels related to the pre-test factor for "new" and "old" items are presented in Table 5. A student's t-test was run on this data. The group that received the pre-test at the second grade level performed significantly better than the control group on these items on the post-test. At the third grade level these findings were reversed. In addition, the data indicate no significant differences when the items are new to both groups.

Data collected on the teacher questionnaires are reviewed in the Discussion Section of this report.

Table 4

Adjusted Means Calculated for Significant F-Ratios for Attitude; Grades 1, 2, and 3

Source	Grade	Level	Means
Pre-test x Materials	2	No Pre-test, Materials	39.65
		Pre-test, No Materials	38.81
		No Pre-test, No Materials	35.70
		Pre-test, Materials	34.91
Pre-test	3	Not Given Pre-test	34.73
		Given Pre-test	32.28
Pre-test x Materials	3	No Pre-test, No Materials	36.42
		Pre-test, Materials	33.52
		No Pre-test, Materials	33.04
		Pre-test, No Materials	31.04

Table 5

(a) Means and Standard Deviations on "Old" and "New" Items for Experimental and Control Levels of Pre-test Factor; Grades 1, 2, and 3.

Grade	Level	"New" $\bar{X}$	"New" S.D.	"Old" $\bar{X}$	"Old" S.D.	n
1	Experimental (Pre-test)	6.40	2.44	5.48	2.37	88
	Control (No Pre-test)	6.26	2.34	5.46	2.41	113
2	Experimental (Pre-test)	4.39	1.83	4.36	2.03	93
	Control (No Pre-test)	4.39	1.59	4.00	1.66	103
3	Experimental (Pre-test)	1.75	1.05	1.68	1.25	100
	Control (No Pre-test)	1.62	1.29	1.87	1.42	85

(b) t-Tests of Differences Between Means

Grade	"New" items t_{exp}	"Old" items t_{exp}
1	.77	.18
2	.00	5.14***
3	.75	-5.00***

NOTE: *** $p < .005$

DISCUSSION

It appears that little support is given to the contention that giving a pre-test at the early elementary school level increases curiosity thereby facilitating learning (Table 1). The teachers' reactions to the study indicated that the questions did not have the arousal effect at the lower grade levels that was expected. Possible explanations involve the long time span between the pre-test and the post-test as well as the attention span of the children. It is important to mention still another variable at this point: the variation of the difficulty of the instructional content among grades might have had a major effect on the respective factors at the three grade levels. Teacher comments seem to indicate that the lessons were too elementary at the first grade level (arithmetic addition) and too difficult at the third grade level (math sets).

Referring again to Table 1, it is interesting to note that the other experimental treatment was highly effective. Making the materials available to the students increased performance at all three grade levels, significantly so for grades 1 and 2. It can be inferred that the simple procedure of making instructional materials available which the young learner can study at his leisure is a highly effective technique. Teachers' comments indicated that large, colorful and professional pictures were most effective.

Turning to another factor, the data indicate that ability was a significant source of variance on the performance variable at the first and third grade levels and approached significance at the second grade level. This result was expected due to the measured differences in cognitive skills among the three ability levels.

Several of the interactions appear to be noteworthy. The pre-test x materials interaction on the performance test at the first grade level indicated that having the materials available, once a pre-test is given, significantly facilitates the learning of the material. This observation is to be expected, for the materials provide the information which the student realizes he is lacking after taking the pre-test.

The pre-test x materials interaction at the second grade level on the attitude test is not easily explained. A possible reason for this interaction is that the pre-test group not receiving the materials may have realized that they were being isolated from the professional reproductions, causing their interest level concerning art and paintings to increase substantially; that is, they may have "wanted" to have these materials. The hypothesis for the group that did not get the pre-test is that those who received the materials became more highly interested in art than those who did not.

At the third grade level, however, the pre-test x materials interaction on the attitude test has taken the opposite form, so it is obvious that alternative explanations are quite possible.

In conclusion, several statements can be inferred from the data generated by this study. First, it can be inferred that the pre-test procedure described in this report at the lower elementary school level is not particularly effective. Recommendations have been made for further experimentation concerning the use of the pre-test in motivating students. It might be interesting to note that plans are being made to rerun the second grade materials at the fourth grade level, using professional tapes and giving the pre-test, lesson, and post-test on the same day [see Experiment 4].

Second, it can be inferred that making relevant instructional materials available to the students is a highly effective procedure to follow. Further experimentation is suggested on variables which might further enhance this effect.

Third, it can be inferred that mental ability is an important consideration when predicting post-test performance. Reliable IQ scores and levels which discriminate clearly among low, average, and high ability are required to assess this effect most accurately.

Fourth, there are few differences between the sexes on performance and attitude scores when a procedure such as the one described in this report is followed.

Finally, it must be recognized that predicted interactions among factors are often confounded by variables which cannot easily be controlled in the classroom. The possibility of one such extraneous variable which may have confounded predicted interaction has been discussed. Repeating a statement by McKeachie (1961), the classroom is indeed a situation of complex stimuli and heterogeneous subjects, both of which invite complex interaction effects.

EXPERIMENT 2: THE MOTIVATIONAL EFFECTS OF DIFFERENT METHODS OF GIVING ASSIGNMENTS

Ausubel (1960) has hypothesized and tested the fact that learning meaningful verbal material can be facilitated by using an "advance organizer." He defined an organizer as introductory material at a high level of abstraction, generality, and inclusiveness; that is, a general, non-technical overview or outline in which the non-essentials of the to-be-learned material are ignored.

Giving homework assignments is an aspect of the classroom procedure which is under the direct control of the teacher, and an assignment could serve as an advance organizer. Student attention is normally increased during the presentation of the class assignment. This assumption suggests that this presentation by the teacher may be manipulated to increase the students' motivation to learn.

In addition to the cognitive effect of the advance organizer, there seems to be an affective effect also. That is, the students seem to be more interested in learning or studying the material if it is explained briefly when the assignment is given. Travers (1964) points out that the "set" with which a subject approaches a task is an important consideration. The instructions given to the subject can greatly affect this set. Bruner, et al., (1956) developed a technique of telling the subject which of the various stimulus dimensions were free to vary, and which were not. Travers points out that this has been found to facilitate learning because it has the effect of decreasing the number of irrelevant dimensions attended to and therefore decreases the amount of information that has to be processed to arrive at a solution. The techniques by which assignments can be given to the student may differentially affect the student's motivational set to learn.

METHOD

Subjects

The Ss were 486 pupils enrolled in the fourth through sixth grades in the Warrior Run School District in Pennsylvania. The schools, as indicated previously, are located in a rural, small town setting.

Experimental Design

Two experimental designs were used in the present study. For one experiment, two fifth grade mathematics classes which were at approximately the same point in the math text, were identified. Pupils in these two classes were randomly assigned to one of four treatments following stratification by teacher and ability. Ability groupings in the first experimental design were defined by selecting IQ ranges such that approximately equal numbers of pupils were assigned to each range. The IQ ranges were defined by finding the mean IQ score for the two classes and determining whether each S was in the above or below average group.

For the second experiment, all remaining students in fourth, fifth, and sixth grade math classes were randomly assigned to one of four treatments following stratification by sex.

The treatments in both designs were the same. Group A received the class assignment written on the chalkboard, with no explanation. Group B received the class assignment orally along with an introductory explanation of the material by the teacher. Group C received the class assignment and introductory explanation written on a sheet of paper which they were allowed to keep. Group D received the same handout sheet as Group C, and, in addition, were given a note to their parents

explaining the procedure of handing out assignments in written form.

The dependent variables for both designs were a locally-developed attitude test and a teacher-made performance test. Both were given only as post-tests.

Essentially, the paradigm for the first study was a 4 x 2 x 2 complete factorial design with unequal n's, while the second study utilized a 4 x 2 complete factorial design with unequal n's. A three-way analysis of variance was used for the first experiment, while a two-way analysis of variance was used for the second.

Procedures

Approximately one week before the beginning of the experimental period, all fourth, fifth, and sixth grade mathematics teachers in the Warrior Run School District met with E. Pupils were assigned to cells, and procedures were developed at this time. Teachers selected the assignments to be given to the Ss and developed appropriate post-tests.

At the end of class on the first day of the experimental period, the teacher passed out the written instructions to Ss in Groups C and D, with Group D also receiving parental notes. These students were then dismissed. Next, the teacher wrote the assignment on the chalkboard, but gave no explanation for the assignment. This constituted the treatment for Group A, and these pupils were then dismissed. Finally, to the remaining pupils (Group B), the teacher read the assignment and enthusiastically gave the rationale for the assignment. This procedure was followed for five days. The post-tests were administered the first thing in class on the sixth day of the experimental period, with the attitude test given first.

All tests were collected and scored by E. Performance test scores (number correct) were transformed into T-scores by class for the second experimental design.

RESULTS

In Table 6 are presented the F-ratios and mean squares for the performance and attitude tests for both experimental designs. On the performance test, significant F-value was found for the teacher factor in the first design. Means for the levels of this factor are found in Table 7.

On the attitude test, significant F-values were found for the treatment and ability interaction in the first design and for treatment in the second design. Means for the levels of these factors are found in Table 7.

A Newman-Keuls analysis for the treatment and ability interaction showed that the Treatment A, low ability group had significantly lower attitudes toward their assignment procedure than the Treatment B, low ability group ($p < .01$), and also lower attitudes than both the Treatment D, low ability and the Treatment C, high ability groups ($p < .05$). A Newman-Keuls analysis for the Treatment factor in the second design showed that the attitude of Group C was significantly more positive than those of Groups A, B (both $p < .01$), and D ($p < .05$).

DISCUSSION

The data generated in the attitude post-test was found to be quite informative. Significant differences in mean responses by the treatment groups in the second experimental design indicated that Treatment C was

Table 6

F-Ratios and Mean Squares for Performance and Attitude

Source	d.f.	Performance MS	Performance F	Attitude MS	Attitude F
(a) FIRST EXPERIMENTAL DESIGN (TWO TEACHERS)					
Treatment (T)	3	3.48	--	16.92	2.30
Ability (A)	1	12.14	1.75	1.37	--
Teacher (TE)	1	71.25	10.29**	3.43	--
T x A	3	5.11	--	47.70	6.48**
T x TE	3	2.24	--	8.00	1.09
A x TE	1	5.20	--	3.16	--
T x A x TE	3	3.09	--	10.52	1.43
Error	41	6.93	--	7.36	
(b) SECOND EXPERIMENTAL DESIGN (ALL REMAINING TEACHERS)					
Treatment (T)	3	59.98	--	90.71	6.47**
Sex (S)	1	53.26	--	24.94	1.78
T x S	3	19.13	--	9.25	--
Error	421	99.38	--	14.02	

**$p < .01$

Table 7

Means for Significant F-Ratios for Performance and Attitude

Dependent Variable	Source	Level	Mean
(a) FIRST EXPERIMENTAL DESIGN			
Performance	Teacher	W	17.34
		H	15.09
Attitude	Treatment by Ability	B, Low	18.80
		D, Low	17.80
		C, High	17.59
		D, High	16.89
		A, High	16.73
		C, Low	14.66
		B, High	14.48
		A, Low	13.04
(b) SECOND EXPERIMENTAL DESIGN			
Attitude	Treatment	C	17.25
		D	16.23
		B	15.62
		A	15.16

by far preferred by the students. That is, the students seemed to be more interested in learning or studying the material if they received the assignment in writing, including a written explanation of why the assignment was important. The important point brought out in the second design was that the Group A pupils demonstrated lower attitudes and lower performance scores than any other group. This result implies that writing an assignment on the chalkboard, without attempting to arouse student interest in the assignment, is not an effective procedure.

Looking at the first design, it became apparent that high ability pupils preferred Treatment C, while the low ability students preferred Treatment B. Both treatments included an interest-arousing element or rationale as part of the assignment. The reasons why the high ability students preferred to have their assignment written while the low ability students preferred a verbal communication are open to debate.

It should be pointed out that large differences developed among groups in performance in the second design, with Groups B and C outperforming the other groups. However, a large error term prevented these differences from attaining statistical significance. Judging from the amount of variance identified by the teacher factor in the first design for performance, much control and reduction of the error term in the second design could have been attained by including the teacher factor.

EXPERIMENT 3: THE MOTIVATIONAL EFFECTS OF CURIOSITY AROUSAL AND TEACHER-ESTABLISHED SET

The significance of curiosity in the classroom is well documented. Maw and Maw (1964) pointed out that several authors support the idea that the development of curiosity should be the most significant aspect of teaching. They went on to state that the value of curiosity seems to be threefold: learning depends upon curiosity; creativity requires curiosity; and sound mental health demands that the individual be curious. Many theorists consider curiosity as a learned or secondary force of motivation, implying that curiosity can be taught (Deese, 1966; Cofer and Appley, 1967).

Berlyne (1954) cited motivation, including curiosity, as one determinant of attention. If attending, in the end, will lead to the gratification of a curiosity drive, motivation to attend should be at a high level. This is assuming that the goal of the curiosity does not interfere with attending to other stimuli. It can be hypothesized that the student will proceed in the direction of a goal (that of gratifying the curiosity drive) once a curiosity drive has been aroused. The gratification of the drive will be rewarding or reinforcing to the learner. If the procedure entails attending to and learning other material before reaching the goal, the student should be motivated to follow this procedure.

METHOD

Subjects

The Ss were 646 pupils (342 males and 304 females) regularly enrolled in the first, second, and third grades at the Dewart, Turbotville,

and Watsontown Elementary Schools in the Warrior Run School District in Pennsylvania.

Experimental Design

The paradigm for the experiment was a 2 x 2 x 3 x 2 x 2 complete factorial design with unequal n's. The independent variables were curiosity condition, set condition, grade, sex, and ability. The dependent variable was performance on a post-test containing 23 multi-choice cognitive items. Students were randomly assigned to one of two levels of the curiosity condition and, also, the set condition following stratification by ability, grade, and sex; ability levels were identified by dividing IQ scores into thirds by grade. Two levels were identified for curiosity: one group received the curiosity treatment while the other group did not. Two levels were similarly identified for the set factor: one group received the introductory set by the teacher, while the other group did not.

Procedures

The experiment was conducted in all schools on the same morning. Classrooms were randomly assigned to receive from their teachers either an introductory set to remember the facts presented on the tape or a general introduction. After the set or no-set conditions had been given, teachers split their classes and exchanged half of their pupils with their experiment partner, so that all students assigned to the curiosity treatment were in one classroom and all students not assigned to the curiosity treatment were in the other classroom.

The teachers giving the curiosity treatment placed a large, colored, odd-shaped container in front of the pupils. They then turned on a tape

recorder and played a taped presentation on Arizona which contained several inserted references; specifically, the speaker was wondering what was in the container. After the tape was finished, the teachers took the materials (a cactus and pictures of Arizona) out of the colorful container and allowed the students to inspect and otherwise interact about them. Before the students returned to their regular classrooms, the multiple choice test was administered to them by having the teachers read each item.

The teachers not giving the curiosity condition placed the cactus and pictures in front of the pupils before the tape recorder was turned on. The taped presentation was identical with the one played to students receiving the curiosity treatment with the exception that references to the odd-shaped container were omitted. After the taped presentation, the students were permitted to examine the materials. Then, the test was administered.

After the taped presentations were played, teachers were requested to complete a 10-item questionnaire aimed at recording their observations of pupil behavior during the experiment. All tests and questionnaires were scored and analyzed by E.

RESULTS

A five-way analysis of variance was used to analyze the data.

Table 8 presents the F-ratios and mean squares for the cognitive test performance. Significant F values were found for the main effects of curiosity ($p < .05$), grade ($p < .001$), sex ($p < .001$), and ability ($p < .001$). Significant interactions included the grade x ability interaction ($p < .01$) and the sex x ability interaction ($p < .05$).

Table 8

F-Ratios and Mean Squares for Performance

Source	d.f.	MS	F
Curiosity (C)	1	70.19	6.37*
Set (S)	1	40.95	3.72
Grade (G)	2	2126.40	193.11***
Sex (SX)	1	341.51	31.01***
Ability (A)	2	504.60	45.83***
C x S	1	14.10	1.28
C x G	2	0.74	--
C x SX	1	0.10	--
C x A	2	9.94	--
S x G	2	13.56	1.23
S x SX	1	5.81	--
S x A	2	15.53	1.41
G x SX	2	30.18	2.74
G x A	4	41.73	3.79**
SX x A	2	36.77	3.34*
C x S x G	2	1.34	--
C x S x SX	1	0.04	--
C x S x A	2	0.85	--
C x G x SX	2	12.84	1.17
C x G x A	4	2.53	--
C x SX x A	2	10.85	--
S x G x SX	2	31.59	2.87
S x G x A	4	26.10	2.37
S x SX x A	2	7.16	--
G x SX x A	4	3.01	--
C x S x G x SX	2	22.67	2.06
C x S x G x A	4	15.45	1.40
C x S x SX x A	2	22.93	2.08
C x G x SX x A	4	14.63	1.33
S x G x SX x A	4	5.98	--
C x S x G x SX x A	4	0.00	--
Error	574	11.01	

* $p < .05$
** $p < .01$
*** $p < .001$

Means for the levels of these significant factors are found in Table 9. The pupils in the non-curious treatment outperformed those in the curious condition ($p < .05$). A Newman-Keuls analysis for the grade factor showed that the differences between grades were all significant at the .001 level. Males outperformed females ($p < .001$). A Newman-Keuls analysis for the ability factor showed that the differences between ability groups were all significant at the .01 level.

A Newman-Keuls analysis for the grade x ability interaction showed that the third grade high ability group performed significantly better than all other cells ($p < .01$). The average ability third grade group, the high ability second grade group, and the low ability third grade group all performed significantly better than the first grade high, average, and low ability groups and the second grade average and low ability groups ($p < .01$). Differences between the remaining groups (see Table 9) most often reached significance.

A Newman-Keuls analysis for the sex x ability interaction showed that the male high ability group significantly outperformed the female average and both the male and female low ability groups ($p < .01$). The difference between the high ability male group and the average ability male group was significant at the .05 level. Both the female high ability group and the average ability male group outperformed the female average and low ability groups and the male low ability group ($p < .01$).

DISCUSSION

It can be inferred from the data that the procedure designed to arouse curiosity described here is not an efficient procedure to

Table 9

Means for Significant F-Ratios for Performance

Source	Level	Mean
Curiosity	No Curiosity	10.46
	Curiosity	9.78
Grade	Third	13.73
	Second	10.60
	First	7.12
Sex	M	10.83
	F	9.33
Ability	High	11.99
	Average	10.17
	Low	8.69
G x A	3, High	16.85
	3, Average	13.17
	2, High	12.25
	3, Low	12.02
	2, Average	11.09
	2, Low	8.87
	1, High	8.31
	1, Average	7.19
	1, Low	6.17
SX x A	M, High	12.41
	F, High	11.52
	M, Average	11.30
	M, Low	9.17
	F, Average	8.90
	F, Low	8.15

facilitate learning in the lower elementary grades. The group who did not receive the curiosity treatment performed significantly better on the post-test. Several unpredicted variables could have entered into the experiment, however, that may have negated any treatment effects. The variability in teachers' methods of implementation of the procedure was observed to be quite large. A few teachers were unfamiliar with the equipment being used. Lack of involvement and complete understanding of the procedures may have diminished any treatment effects.

It can be hypothesized, in addition, that the materials used in the curiosity treatment may have distracted the Ss from attending to the taped presentation. It is recommended that a procedure be developed that arouses curiosity, but not at the expense of blocking the reception of information. Possibly it would be wise to develop a treatment that would allow pupils to satisfy curiosity as a reward for good performance.

Finally, it is informative to note the large amount of variance identified by the sex, grade, and ability factors and their interactions. It is recommended that these factors be included in future research designs concerned with this problem on the lower elementary grade level.

EXPERIMENT 4: THE MOTIVATIONAL EFFECTS OF PRE-TESTS AND FEEDBACK

Berlyne (1954b) first suggested that the arousal effects of pre-questioning had useful implications for learning. He designed a study concerned with the concept of "epistemic curiosity" which he defined as a drive that is aroused by a question and reduced by rehearsing its answer. In his study, an experimental group received a pre-test about invertebrate animals, a series of statements providing answers to the pre-test questions, and a post-test repeating the questions. A control group was given the series of statements and the post-test, but not the pre-test. Berlyne concluded that the data tended to confirm the hypothesis that pre-questioning arouses curiosity and that statements recognized as answers to questions from the pre-test are more likely than others to be recalled in the post-test.

Olds (1956), who was concerned with the growth of motives, stated that motivation is provided by curiosity when something is not explained and by goals when an object system is engaged. This statement is relevant in explaining how the pre-test arouses curiosity. Maw and Maw (1964) came to the conclusion that the values of curiosity seem to be threefold in that learning depends on curiosity, creativity requires curiosity, and sound mental health demands that the individual be curious.

Other than its arousal value, the pre-test also provides an instructional set for the learner. That is, it aids the student in becoming selectively attentive to certain stimulus events that bring about behavior changes that are the sign of learning. Gagné (1965) stated that the student must be attentive to the stimulation regardless

of how it is presented, if he is to learn. Travers (1964) stated that the use of an instrument such as a pre-test should facilitate learning by decreasing the number of irrelevant dimensions in the stimulus situation, therefore decreasing the amount of information that has to be processed.

In Experiment 1 discussed above, Sanders developed a procedure of giving a pre-test to school children in grades 1-3, presenting a week-long instructional unit, and then giving a post-test. He concluded that little support was given to the contention that using this procedure increased achievement significantly at the early elementary school level. It was suggested that the procedure might be more effective when used with older children, using professional materials, giving feedback to the learner immediately after the pre-test is administered, and presenting the pre-test, the lesson, and the post-test all in the same day; the following study developed from these suggestions.

METHOD

Subjects

The Ss were 186 pupils (92 males and 94 females) regularly enrolled in the fourth grades at the Watsontown and Turbotville Elementary Schools in the Warrior Run School District in Pennsylvania. Subjects were stratified by school, sex, and IQ and then randomly assigned to one of three treatment groups.

Experimental Design

The paradigm for the experiment was a 3 x 2 x 2 x 3 complete factorial design with unequal n's. The respective independent variables

were treatment, school, sex, and ability. The dependent variable was performance on a post-test containing 20 cognitive items.

Three levels were included in the treatment factor. Group A received a relevant pre-test, relevant feedback, the presentation and the post-test. Group B received a relevant pre-test, irrelevant feedback, the presentation, and the post-test. Group C received an irrelevant pre-test, irrelevant feedback, the presentation, and the post-test. Ability levels were identified by the following IQ ranges:

High: Above 107

Medium: 98-107

Low: Below 98

Procedures

In the experiment all three treatments were administered in each class so the names of the students were written on the appropriate pre-tests and feedback sheets to insure that each S received the correct treatment. The pre-tests were given first; Groups A and B received a pre-test related to the instructional lesson while Group C received a pre-test unrelated to the lesson. The relevant pre-test consisted of 10 cognitive items about art. The irrelevant pre-test consisted of 10 cognitive items about math. After the students completed the pre-tests, they were collected by the teachers. The appropriate feedback sheets were then passed out to the Ss. The relevant feedback or answer sheets contained answers to the art pre-test questions (Group A only). The irrelevant feedback sheets contained answers to the math pre-test questions (Groups B and C). The students were told to read over the answer sheets and study them.

After five minutes, the feedback sheets were collected. An audio-

visual presentation about art was then presented using a slide projector and tape recorder; this, in consecutive form, was the same art lesson used with the second grade in Experiment 1. After the presentation, all students were given the same 20-question art post-test, the dependent variable for this study. After the post-tests had been completed by the Ss, the teachers collected them and returned them to E. The tests were scored and analyzed by E.

RESULTS

A four-way analysis of variance was used to analyze the data. In Table 10 are presented the F-ratios and mean squares for the post-test performance. Significant F values were found for ability ($p < .001$), the school x ability interaction ($p < .05$) and the school x sex x ability interaction ($p < .05$). Means for the levels of these factors are found in Table 11.

A Newman-Keuls analysis for the ability factor showed that the differences between the means of all three ability groups were significantly different ($p < .01$). A Newman-Keuls analysis for the school x ability interaction showed the Turbotville low ability group performing poorer than all other groups at the .05 level, and the difference reached the .01 level with the high ability groups from both Turbotville and Watsontown. Additionally, the Watsontown average and low ability groups were significantly lower than the high ability groups from both schools ($p < .05$). The Turbotville low ability males and females performed significantly poorer than three high ability groups: Turbotville females and Watsontown males and females ($p < .01$ except $p < .05$ for the difference between Turbotville low ability males and Watsontown high ability females). Additionally, the Turbotville high ability females significantly out-performed the Watsontown average and low ability males ($p < .01$).

TABLE 10

F-Ratios and Mean Squares for Performance

Source	d.f.	MS	F
Treatment (T)	2	5.85	-
School (S)	1	3.51	-
Sex (SX)	1	18.67	2.59
Ability (A)	2	114.06	15.79***
T x S	2	3.23	-
T x SX	2	6.17	-
T x A	4	5.50	-
S x SX	1	0.12	-
S x A	2	27.21	3.77*
SX x A	2	3.80	-
T x S x SX	2	2.25	-
T x S x A	4	3.77	-
T x SX x A	4	7.22	1.00
S x SX x A	2	22.93	3.18*
T x SX x S x A	4	7.84	1.09
Error	150	7.22	

* $p < .05$
*** $p < .001$

TABLE 11

Means for Significant F-Ratios for Performance

Source	Level	Mean
Ability	High	11.60
	Average	10.07
	Low	8.75
S x A	Turbotville, High	11.67
	Watsontown, High	11.53
	Turbotville, Average	10.49
	Watsontown, Average	9.70
	Watsontown, Low	9.66
	Turbotville, Low	7.75
S x SX x A	Turbotville, F, High	13.05
	Watsontown, M, High	11.63
	Watsontown, F, High	11.44
	Turbotville, M, Average	10.70
	Turbotville, F, Average	10.28
	Turbotville, M, High	10.26
	Watsontown, F, Low	10.25
	Watsontown, F, Average	10.13
	Watsontown, M, Average	9.25
	Watsontown, M, Low	9.05
	Turbotville, M, Low	7.91
	Turbotville, F, Low	7.60

DISCUSSION

The data give little empirical support to the contention that the procedure of (1) giving a daily pre-test, (2) giving feedback on the pre-test, and (3) presenting an instructional unit which is relevant to the questions asked on the pre-test, facilitates learning. Small differences in the predicted direction were found among the three treatment groups (Group A>Group B>Group C), but these differences did not approach significance. It is quite possible that although the suggested procedures were effective, the variability in teachers' methods of implementation may have diminished the effect. It was observed that several teachers had difficulty in the implementation, and a few lacked the involvement in the study that the other teachers possessed. The teacher variable, although it should have affected the three treatment groups equally, could have diminished the effect of the treatments.

It may also be suggested that the treatment might be more effective if established as a daily or routine practice rather than as a one-shot dose. The learners' adaptation to the new procedure and development of learning strategies may take a few days, especially at this early age. It is suggested that a periodic application of the experimental procedure be studied in order to increase the power of the treatment.

Finally, it is instructive to note, in identifying sources of variance, that the sex and ability factors contribute a substantial amount of variance in the data. Future studies should consider this fact in developing experimental designs.

EXPERIMENTS 5 and 6: THE MOTIVATIONAL EFFECTS OF TEACHER COGNIZANCE OF COLLECTED AND NON-COLLECTED HOMEWORK

The question of what happens to students' homework papers is a crucial one because of the motivational aspects involved. Klausmeier and Goodwin (1966) pointed out that concrete and symbolic rewards are sought by children and can even serve the purpose of getting people to perform inherently unpleasant tasks. If the tasks are pleasant or important to the students, no rewards would be necessary. However, homework assignments are seldom seen as very important or pleasant to the typical student.

Plowman and Stroud (1942) showed that reinforcement of correct responses promoted efficient learning. They returned its corrected test papers to one group of students and gave them five minutes to go over the papers. The second group did not have its papers returned. One week later, the same test was administered and the first group performed significantly better.

A study by Page (1958) showed appropriate and natural teacher comments had a facilitating effect on student motivation. One-third of the subjects had their tests returned with no teacher comments, another third with natural and appropriate teacher comments, and one-third had their tests returned with specified but generally encouraging teacher comments. On their next exam, the second group scored significantly high while the first group scored significantly low. These studies emphasized the motivational significance of evaluative practices beyond merely marking "right" or "wrong" items. That is, the personal comment by the teacher and feedback methods increased the effectiveness of the learning environment.

The present experiments were designed to study the differential effects that several methods of handling homework have on different types of students.

METHOD

Subjects

The Ss for Experiment 5 were 143 fifth grade pupils (76 males and 67 females); for Experiment 6, 185 sixth grade pupils (83 males and 102 females) were used. All Ss were regularly enrolled in the Turbotville and Watsontown Elementary Schools in the Warrior Run School District in Pennsylvania. Subjects were stratified by school and sex in each experiment and then randomly assigned to one of three treatment groups.

Experimental Design

The experiments were designed to attack the problem presented in the introduction. At the fifth grade level (Experiment 5), the paradigm for the experiment was a 3 x 2 x 2 complete factorial design with unequal n's. The respective independent variables were treatment, school, and sex. The three levels of the treatment factor for the fifth grade were:

(A) Homework was scored and collected, recorded by the teacher and then returned to the student;

(B) Homework was scored and collected, not recorded by the teacher, but returned to the student; and

(C) Homework was scored and collected, not recorded by the teacher, and not returned to the student.

The dependent variable was performance on a cognitive post-test.

At the sixth grade level (Experiment 6), the paradigm for the experiment was also a 3 x 2 x 2 complete factorial design with unequal

n's. The independent variables were treatment, school, and sex. The three levels of the treatment factor for the sixth grade were:

(A) Homework was scored, not collected, but was recorded by the teacher (Ss assigned to this treatment were told in advance that all of their homework scores would be recorded);

(B) Homework was scored, not collected, but was randomly recorded (the Ss assigned to this treatment were told in advance that their homework scores would be recorded occasionally); and

(C) Homework was scored, not collected, and not recorded by the teacher (the Ss assigned to this treatment were told in advance that their homework scores would never be recorded).

The dependent variable was performance on a cognitive post-test.

Procedures

In Experiment 5, a math lesson which had been prepared by E earlier, was assigned at the end of class on Friday. On the following Monday, the pupils exchanged their papers and scored them. Pupils then received their papers back and were allowed to look at them for three minutes. The teacher then collected the homework and assigned Lesson 2. On Tuesday, the teachers handed back the homework of certain pupils, some of which had natural teacher comments on them (Group A). Then, the same procedure used on Monday was followed. This procedure was followed on Wednesday and Thursday. On Friday, the post-test covering the five lessons was given to all students the first thing in arithmetic class. The tests were collected and scored by E.

In Experiment 6, a math lesson which had been prepared by E earlier, was assigned at the end of class on Friday. In addition, it was announced that during the next week, the teacher was going to record the scores that certain students made on their homework. Those students assigned to Treatment A were told that their scores would be recorded every day. Those students assigned to Treatment B were told that their scores would only be recorded occasionally. Those students assigned to Treatment C were told that their scores would never be recorded during the next week. Whose paper would be recorded on any given day for Treatment B was up to chance. On Monday, the pupils exchanged papers and scored them; the papers were then returned. The scores of certain students (depending on their treatment group) were recorded at this time by the teacher. At the end of the class, Lesson 2 was assigned, and the students were reminded that only certain people would have their scores recorded. This same procedure was followed for Tuesday, Wednesday, and Thursday. On Friday, the post-test was given to all students the first thing in arithmetic class. The tests were collected and scored by E.

RESULTS

A four-way analysis of covariance was used to analyze the data. The covariate was the students' non-verbal scores on an IQ test given earlier in the year. The computer program used to analyze the data was the BMD05V (UCLA, 1964).

In Table 12 are presented the F-ratios and mean squares for the post-test performance at the fifth grade level (Experiment 5). A significant F value was found for the covariate ($p < .001$), but no other effects reached significance.

Table 12

F-Ratios and Mean Squares for Performance; Experiment 5

Source	d.f.	MS	F
Treatment (T)	2	9.37	1.01
School (S)	1	6.89	--
Sex (SX)	1	0.48	--
T x S	2	0.90	--
T x SX	2	9.75	1.05
S x SX	1	3.30	--
T x S x SX	2	0.47	--
Covariate	1	646.76	69.69***
Error	130	9.28	

*** $p < .001$

The F-ratios and mean squares for the post-test performance at the sixth grade level (Experiment 6) are recorded in Table 13. Significant F values were found for school ($p < .01$) and the covariance ($p < .001$). Means for the levels of the school factor were: Watsontown 17.49; and Turbotville 15.92.

DISCUSSION

Information derived from a questionnaire given to the teachers in the present study indicated that the treatments did not have much power in their classrooms. In both Experiments 5 and 6, the consensus was that the teachers noticed only slight, if any, differences in behavior among students who received the three treatments. On the other hand, the teachers indicated that they and their pupils both preferred the first treatment in both experiments. However, no treatment tended to motivate the students more than another, according to the teachers.

The data supports the observations made by the teachers. No significant differences were found for the treatment in either experiment. It is possible that variability in the methods used to implement the study by the teachers could have diminished the treatment effects. It was observed that several teachers were resistant to changing methods which they had used for years. In fact, one teacher remarked that she questioned the value of the time spent on writing comments on the students' papers. If the teachers expected no new procedures to motivate the students, this expectation could have become a self-fulfilling prophesy (Rosenthal, 1966, 1968).

The treatments at the fifth grade level might have been made more powerful if the teachers informed the students of what they were doing.

Table 13

F-Ratios and Mean Squares for Performance; Experiment 6

Source	d.f.	MS	F
Treatment (T)	2	0.98	--
School (S)	1	100.43	7.09**
Sex (SX)	1	39.80	2.81
T x S	2	1.97	--
T x SX	2	6.81	--
S x SX	1	10.72	--
T x S x SX	2	0.10	--
Covariate	1	1389.13	98.06***
Error	172	14.17	

** $p < .01$

*** $p < .001$

In addition, it is possible that the experimental period at both grade levels was not long enough to be effective. If the procedure described here were set up as a daily routine for several weeks, the treatments may have had more of an effect on the students.

Finally, it is instructive to note that the school factor at the sixth grade level identified a considerable amount of variance. Future studies should consider this factor when constructing experimental designs.

SUMMARY AND CONCLUSIONS

The reports on the six experiments reflect the majority of the activities conducted in the Warrior Run School District during the first year of their operational Title III Program. The investigation of motivation options open to the elementary teacher continues to be seen as an important and viable activity to pursue.

The experimental results of most importance occurred in Experiments 1, 2, and 3; in these studies treatment had an effect. Results from the first experiment strongly suggest that posting relevant instructional materials for student inspection does motivate the student and does facilitate his learning. Results from the first and fourth experiments are indicative either that pre-tests do not motivate young pupils or that the motivational effects do not occur until after an extended experimental period, allowing children to learn the ramifications of pre-tests. Thus, we find the hard-to-believe result in Experiment 4 that students given a pre-test, and also the correct answers to that pre-test, do no better on the post-test 30 minutes later than students who have not had this pre-test and relevant feedback.

From Experiment 1, one is also impressed by the strange findings that pupils not receiving a particular experimental treatment expressed higher interest in the subject field used as part of the experiment (especially in the third grade study). Reactivity between the treatment conditions could be the cause of this result; pupils within the same school are involved in both conditions and information about the treatment condition is readily available. The "have-nots" may have had higher anticipations of the experimental treatment involved than those pupils who actually experienced it.

The third experiment on curiosity resulted in provocative outcomes. The curious condition proved to be not as effective as the non-curious condition. In implementing the curious treatment, the method used may have been inappropriate; with their attention focused on hidden materials, pupils under the curious treatment may have been inordinately distracted from listening to the cognitive material presented (see Technical Document #8).

As indicated in the summary of several of the experiments, non-significant treatment effects did occur. The possible explanations for these occurrences are many and are summarized extensively in the discussion section of each of the several experiments. Given the fact that differences between treatments were often statistically non-significant, Project personnel were frequently left with the question of whether this non-significance was true in fact or whether the results were indicative of a failure to control sufficiently the effect of extraneous variables in the field research settings. The consensus of those involved with the program (relative to the experimental results obtained) was that more attention must be given to systematic monitoring of the administration of treatments as well as to additional training for those teachers serving as sub-experimenters.

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